CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION

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TENTATIVE

ORDER NO. R4-2010-XXXX AMENDING ORDER NO. R4-2003-0134 AND MONITORING AND REPORTING PROGRAM CI-8654

WASTE DISCHARGE AND WATER RECYCLING REQUIREMENTS FOR HARBOR WATER RECYCLING PROJECT - DOMINGUEZ GAP BARRIER PROJECT (File No. 97-208)

ISSUED TO

City of Los Angeles Department of Water & Power
City of Los Angeles Department of Public Works
Los Angeles County Department of Public Works, and
Water Replenishment District of Southern California

The California Regional Water Quality Control Board, Los Angeles Region (hereafter Regional Board) finds:

BACKGROUND

1. On October 2, 2003, the Regional Board adopted Order No. R4-2003-0134 for the Harbor Water Recycling Project (HWRP) – Dominguez Gap Barrier (Barrier) Project, which injects reverse osmosis treated recycled water[1] (recycled water) and imported diluent water[2] into the Barrier, via injection wells.

2. The Barrier is comprised of a line of 94 injection wells connected by a common header along the south-facing coast of the West Coast Basin in the community of Wilmington, north of Terminal Island and west of the Los Angeles River (Figure 1). The well alignment extends eastward on E Street from the Palos Verdes Hills to the Dominguez Channel, where it turns towards the northeast along the western bank of the channel. Water is injected into the 200-Foot Sand aquifer in the east-west alignment of the Barrier, and into both the 200-Foot Sand and 400-Foot Gravel aquifers in the north-south alignment of the Barrier. The total span of the injection well alignment is approximately 6.2 miles.

1. The recycled water is produced from the Advanced Wastewater Treatment Facility (AWTF) located at the City of Los Angeles' Terminal Island Water Reclamation Plant (TIWRP).
2. Imported diluent water is water that **is not** treated wastewater and is used to supplement the recycled water in the Barrier. Imported diluent water is purchased from the West Basin Municipal Water District (WBMWD).

3. The total volume of recycled water recharged by injection shall not exceed 5 million gallons per day (mgd) and 50 percent of the total injected water into the Barrier. Up to 10 mgd of the total water used for injection is being introduced in two distribution headers (Figure 1):

   A. Imported diluent water at the northern end of the Barrier to provide 100 percent diluent water to the wells along the north/south alignment; and,

   B. Recycled water near the midpoint of the east-west alignment of the Barrier, connected to the TIWRP via a transmission line, to provide 100 percent recycled water to the wells along the east/west alignment.

   Blending of recycled water and diluent water occurs within the aquifers.

4. Order No. R4-2003-0134 contains two recycled water monitoring programs in aquifers as following:

   A. Tracer monitoring program specified in Section IV.4. of the Order is used to track movement of recycled water in aquifers in order to determine pathways, distribution, and travel time of recycled water in aquifers.

   B. Compliance well program specified in Section V. of the Order is used to monitor impacts of recycled water on water quality of aquifers.

5. The 2006, 2007, 2008 and 2009 Annual Engineering Reports show the following results:

   A. **The travel times of groundwater from the Barrier to the nearest drinking well CWS No. 75A**

   The travel times are based on two groundwater transport methodologies using empirical Average Linear Groundwater Velocity[3] (Table 1) and software MODFLOW[4] (Table 2). All results show that the travel times of groundwater between the Barrier and the nearest drinking well CWS No. 75A are expected to be more than 12 years. The location of the nearest drinking well CWS No. 75A is 9000 feet away from the Barrier.

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3. Average Linear Groundwater Velocity $(v) = ki/n_e$,
   where k = hydraulic conductivity of soil, i = hydraulic gradient of soil, and n_e = effective porosity of soil. The Average Linear Groundwater Velocity results from measured field data of k, i, and n_e.
4. The MODFLOW simulation model, based on a model developed by Camp Dresser & McKee, was updated, improved, and converted into public domain software to simulate groundwater flow and recycled water transport.

Table 1 – Results of Average Linear Groundwater Velocity Calculation

Column A: Annual Engineering Report	**Column B:** Annual Travel[5] Distance away from Barrier (ft)	**Column C:** Total[6] Annual Travel Distance away from Barrier (ft)	**Column D:** Average Annual Travel Distance (ft)	**Column E:** Remaining Years[7] to Reach Drinking Well CWS No. 75A (yrs)
2006	657	548[8]	657[9]	12.9
2007	415	963	525[10]	15.3
2008	415	1378	486[11]	15.7
2009	498	1876	489[12]	14.6

Table 2 – Results of MODFLOW Prediction

Column F: Annual Engineering Report	**Column G:** Total[13] Annual Travel Distance away from Barrier (ft)	**Column H:** Average Annual Travel Distance (ft)	**Column I:** Remaining Years[14] to Reach Drinking Well CWS No. 75A (yrs)
2006	346[15]	415[16]	20.9
2007	1000	545[17]	14.7
2008	1700	600[18]	12.2
2009	1800	470[19]	15.3

B. **The travel times of recycled water in aquifers from injection wells to ¼ compliance wells**

Using cumulative groundwater travel times calculated and presented in all Engineering Reports, it was estimated that recycled water front would be one

5. Result of Average Linear Groundwater Velocity calculation.
6. Sum of previous annual travel distance of groundwater and current annual travel distance of groundwater.
7. Column E = [(9000 feet) – (Column C)]/(Column D)
8. Total travel time is based on 10 months. Therefore, 584 feet = (657 feet/year)/(12 month/year) × 10 month.
9. (586 feet/10 month) × 12 month/year = 657 feet/year
10. (963 feet/22 month) × 12 month/year = 525 feet/year
11. (1378 feet/34 month) × 12 month/year = 486 feet/year
12. (1876 feet/46 month) × 12 month/year = 489 feet/year
13. Result of MODFLOW simulation model.
14. Column I = [(9000 feet) – (Column G)]/(Column H)
15. Total travel time is based on 10 months. Therefore, 346 feet = (415 feet/year)/(12 month/year) × 10 month.
16. (346 feet/10 month) × 12 month/year = 415 feet/year
17. (1000 feet/22 month) × 12 month/year = 545 feet/y
18. (1700 feet/34 month) × 12 month/year = 600 feet/year
19. (1800 feet/46 month) × 12 month/year = 470 feet/year

year away from the ¼ compliance wells Wilmington 1 and Wilmington 2 (Figure 1) by November 2009.

C. **Tracer monitoring**

Total Dissolved Solids, Sulfate, Chloride, Boron, and Total Hardness contained in recycled water are used as groundwater tracers to follow the recycled water movement. It is because the concentrations of these chemicals are chemically distinct from and lower than potable water and native groundwater due to the advanced wastewater treatment facility, particularly reverse osmosis. The tracer monitoring results in Table 3 indicate the recycled water only moves a couple of hundred feet away from the injection wells after 4-years of operation. The absence of recycled water at the three observation wells at 27YC is expected as these wells are located hydraulically upgradient far enough away from the recycled water injection point that they receive 100% imported diluent water. Results at 23T7, 25KQ, and 25XB confirm that recycled water is going into the Barrier along the east/west alignment mainly from the east to the west then slowly to the north, but is not moving appreciably to the east (Figure 2).

Table 3 – Results of Tracer Monitoring between 2006 and 2009

Tracer Well Location	Well No.	Aquifer Screened	Distance to Nearest Injection Well (ft)	Recycled Water Detected?	Evidence for Recycled Water	First Appears in Well (mo)
23T7	312D	200-Foot Sand	315	Yes	TDS, SO_4, Cl, B, SO_4/B, Cl/B	3
24EH	322E	200-Foot Sand	250	No	--	--
24XZ	332J	200-Foot Sand	320	No	--	--
24Y6	332B	200-Foot Sand	610	No	--	--
24Y6	332C	200-Foot Sand	610	Possible	TDS, SO_4, Cl, Hardness	21
24Y6	332D	200-Foot Sand	610	Possible	TDS, SO_4, Cl,	16
25EH	342A	200-Foot Sand	430	No	--	--
25KQ	342	200-Foot Sand	100	Yes	TDS, SO_4, Cl, SO_4/B, Cl/B	1
25XB	352C	200-Foot Sand	170	Yes	SO_4, Cl, B, SO_4/B, Cl/B	10
26DJ	351D	200-Foot Sand	420	No	--	--
26JN	351G	200-Foot Sand	420	Possible	Cl	25
26JN	351F	400-Foot Gravel	420	Possible	Cl	25
24Y17	331	200-Foot Sand	1,700	No	--	--

Tracer Well Location	Well No.	Aquifer Screened	Distance to Nearest Injection Well (ft)	Recycled Water Detected?	Evidence for Recycled Water	First Appears in Well (mo)
24Z26	331C	200-Foot Sand	2,575	No	--	--
27YC	879XX	Gaspur	310	No	--	--
27YC	879WW	200-Foot Sand	310	No	--	--
27YC	879VV	400-Foot Gravel	310	No	--	--
23T28	311D	200-Foot Sand	2,380	No	--	--
23Y15	322D	200-Foot Sand	1,535	Inconclusive	--	--

Conclusion: Based upon the above results, the retention time of recycled water in the aquifers is more than 12 years prior to extraction from the nearest drinking well CWS No. 75A. This retention time complies with the requirement, specified in Table 3 of Order No. R4-2003-0134, in which the minimum retention time underground of recycled water is at least 12 months prior to extraction from domestic supply wells. Recycled water moving through the aquifers is afforded an extra level of treatment through soil filtration; the longer the water stays underground, the more likely trace organic and inorganic chemicals would be removed through the filtration process. In addition, virus decay with time and a 12-month retention time provides a significant log reduction in the virus density in the recycled water. Furthermore, virus density shall be greatly minimized through a more-than-12-year retention time in soils. Therefore, it is reasonably believed that the deletion of five ½-distant permit compliance wells and tracer monitoring program is safe and won't impact the quality of groundwater extracted at the drinking well CWS No. 75A.

6. On December 16, 2009, the Water Replenishment District of Southern California (WRD) requested amendments to the groundwater monitoring requirements specified in Monitoring and Reporting Program (MRP) CI-8654, adopted by this Regional Board on October 2, 2003. WRD requested to amend the following four monitoring requirements:

   A. Reduction of the monitoring frequency of some constituents listed in Table E on Page T-15 of the MRP CI-8654;

   B. Replacement of four 3-month permit compliance wells[20] 24XZ-332J, 26BC-351AE,

20. Pursuant to Section V.1. of Order No. R4-2003-0134 adopted by this Regional Board on October 2, 2003, 3-month groundwater monitoring wells for the Harbor Water Recycling Program – Dominguez Gap Barrier Project are required to be established and to be approved by the CDPH and the Regional Board. WRD submitted the Plan of 3-Month Groundwater Monitoring Wells and Groundwater Tracer Program to the CDPH on October 20, 2003. The CDPH approved the Plan with revision on November 14, 2003. The Regional Board approved the revised Plan on November 19, 2003.

26BC-351AD, and 26BC-351AC with new compliance wells[21] 23T7-312D, 26JN-351G, 26JN-351F, and Wilmington 2, respectively;

C. Elimination of the five ½-distant permit compliance wells[22] 26E69 (3 nested wells) and 25A48 (2 nested wells); and,

D. Elimination of the tracer monitoring program[23].

7. These requests were based upon the WRD's groundwater monitoring data collected from 2003 to 2008, which were presented by WRD at the November 12, 2009 meeting between Regional Board staff and the California Department of Public Health (CDPH) staff. After reviewing the data and the tables provided in the December 16, 2009 letter, CDPH and Regional Board staff generally agreed with the WRD's requests. The proposed modifications of the groundwater monitoring program have been demonstrated to not adversely affect the receiving groundwater quality.

8. On January 4, 2010, CDPH conditionally approved WRD's requests. WRD was required to update the monitoring frequency of constituents listed in Table E of Page T-15 of the MRP CI-8654 presented in WRD's December 16, 2009 letter, which were inconsistent with the current monitoring requirements.

9. On March 25, 2010, WRD sent a letter in response to the CDPH's January 4, 2010 letter.

10. In early April, Regional Board staff via a telephone call requested WRD to clarify the monitoring frequency of constituents listed in Table E in WRD's March 25, 2010, response letter to CDPH. On May 11, 2010, Regional Board staff received WRD's email containing the revised monitoring frequency of constituents. The monitoring frequency of the constituents listed in Table 4 is quarterly. The monitoring frequency for the other constituents listed in Table E of the MRP CI-8654 is revised as annually.

Table 4 – List of Constituents with Quarterly Monitoring Frequency

Constituent		
Water level elevation	Corrosivity	Zinc
Total organic carbon	Forming agents	Aluminum

21. Well 23T7-312D is installed in a better location than well 24XZ-332J, to monitor recycled water in the aquifer and wells 26JN-351G, 26JN-351F, and Wilmington 2 are replacement wells for 26BC-351AE, 26BC-351AD, and 26BC-351AC, which have become plugged with bentonite clay.
22. Five ½-distant permit compliance wells are required by and listed in Table F, Section IV.5.B of Monitoring and Reporting Program CI- 8654, which was adopted by this Board on October 2, 2003.
23. Pursuant to Section IV.4. of Order No. R4-2003-0134 adopted by this Regional Board on October 2, 2003, a tracer monitoring program for the Harbor Water Recycling Program – Dominguez Gap Barrier Project is required to be implemented.

Constituent		
Total coliform bacteria	Iron	Nitrate
Total nitrogen	Manganese	Nitrite
Turbidity	Odor	Silver
Chloride	Specific conductance	Methyl-tert-butyl-ether
Color	Sulfate	Thiobencarb
Copper	Total Dissolved solids	---

11. Section VI. MONITORING FREQUENCIES specified in the current Monitoring and Reporting Program CI- 8654 states:

> *"Monitoring frequencies may be adjusted by the Executive Officer to a less frequent basis if requested by the Discharger, and if backed by statistical trends of the monitoring data."*

On June 7, 2010, the Executive Officer approved WRD's request 6.A. and request 6.B.

12. Since, WRD's requests 6.C. and 6.D. will eliminate existing requirements, the requests are subject to approval by the Regional Board.

PURPOSE OF ORDER

13. This Order is an Amendment to the Water Recycling Requirements and Waste Discharge Requirements issued to the four proponents (collectively referred hereinafter as Dischargers) described above for the HWRP Barrier Project, pursuant to California Water Code Section 13523.1. The Dischargers are individually and collectively responsible for compliance with the requirements in this Amendment.

The Regional Board has notified the Dischargers and interested agencies and persons of its intent to adopt an Amendment to Order No R4-2003-0134, and has provided them with the opportunity to submit their written comments.

The Regional Board, in a public meeting, heard and considered all comments pertaining to the discharge and to the requirements.

IT IS HEREBY ORDERED that the City of Los Angeles' Department of Public Works, the City of Los Angeles Department of Water and Power, the Water Replenishment District of Southern California, and the Los Angeles County Department of Public Works shall comply with the following requirements:

TENTATIVE

1. In Finding 43, Table 3 – Recycling Criteria for Groundwater Recharge Reuse on page 10 of Order No. R4-2003-0134 delete "and ½". In Footnote ** on page 11 delete "and the one half."

2. In Section IV.4. on page 18 of Order No. R4-2003-0134 delete "and tracer" in the first and second sentences and change "programs" to "program."

3. In Section V.1.A. on page 19 of Order No. R4-2003-0134 delete "and ½" and change "distances" to "distance."

4. Section IV.5.B. Specifications of Monitoring Wells of the MRP CI-8654 shall be amended as follows:

   Delete the five ½ distant permit compliance wells, 26E69 (4S/13W-29H05, 4S/13W-29H06, and 4S/13W-29H07) and 25A48 (4S/13W-32B01 and 4S/13W-32B02), listed in Table F of Monitoring and Reporting Program CI-8654.

Table F – Dominguez Gap Barrier Project Monitoring Wells			
Well No.	**Perforation Zone and Interval (feet)**	**Aquifer**	**Location**
Wilmington 1			
4S/13W-28A01	Zone 1 (915-935)	Lower Silverado	1500 block of Lomita Blvd., west of Alameda avenue (1/4 distance to nearest domestic well from northern portion of barrier)
4S/13W-28A02	Zone 2 (780-800)	Lower Silverado	
4S/13W-28A03	Zone 3 (550-570)	Upper Silverado	
4S/13W-28A04	Zone 4 (225-245)	400- FT Gravel	
4S/13W-28A05	Zone 5 (120-140)	200-FT Sand	
~~**26E69**~~			
~~4S/13W-29H05~~	~~Zone 1 (121-156)~~	~~200-FT Sand~~	~~42 ft N of Lomita Blvd., 215f east of Wilmington avenue (1/2 distance to nearest domestic well from northern portion of barrier)~~
~~4S/13W-29H06~~	~~Zone 2 (201-381)~~	~~400- FT Gravel~~	
~~4S/13W-29H07~~	~~Zone 3 (424-724)~~	~~Upper Silverado~~	
Wilmington 2			
4S/13W-32F01	Zone 1 (950-970)	Lower Silverado	943 Lagoon Avenue, south of Opp Street (1/4 distance to nearest domestic well from southern portion of barrier)
4S/13W-32F02	Zone 2 (775-755)	Lower Silverado	
4S/13W-32F03	Zone 3 (540-560)	Upper Silverado	
4S/13W-32F04	Zone 4 (390-410)	400- FT Gravel	
4S/13W-32F05	Zone 5 (120-140)	200-FT Sand	
~~**25A48**~~			
~~4S/13W-32B01~~	~~Zone 1 (275-365)~~	~~400- FT Gravel~~	~~16 ft north of "M" street, 75 ft west of~~

Table F – Dominguez Gap Barrier Project Monitoring Wells			
Well No.	**Perforation Zone and Interval (feet)**	**Aquifer**	**Location**
~~4S/13W-32B02~~	~~Zone 2 (95-235)~~	~~200-FT Sand~~	~~Marine avenue (1/2 distance to nearest domestic well from southern portion of barrier)~~

5. Elimination the tracer monitoring program.

6. All other provisions and requirements of Order No. R4-2003-0134 not in conflict with this Amendment remain in full force and effect.

7. This Amendment takes effect upon its adoption.

I, Samuel Unger, Interim Executive Officer, do hereby certify that the foregoing is a full, true and correct copy of an order adopted by the California Regional Water Quality Control Board, Los Angeles Region, on October 7, 2010.

Samuel Unger
Interim Executive Officer

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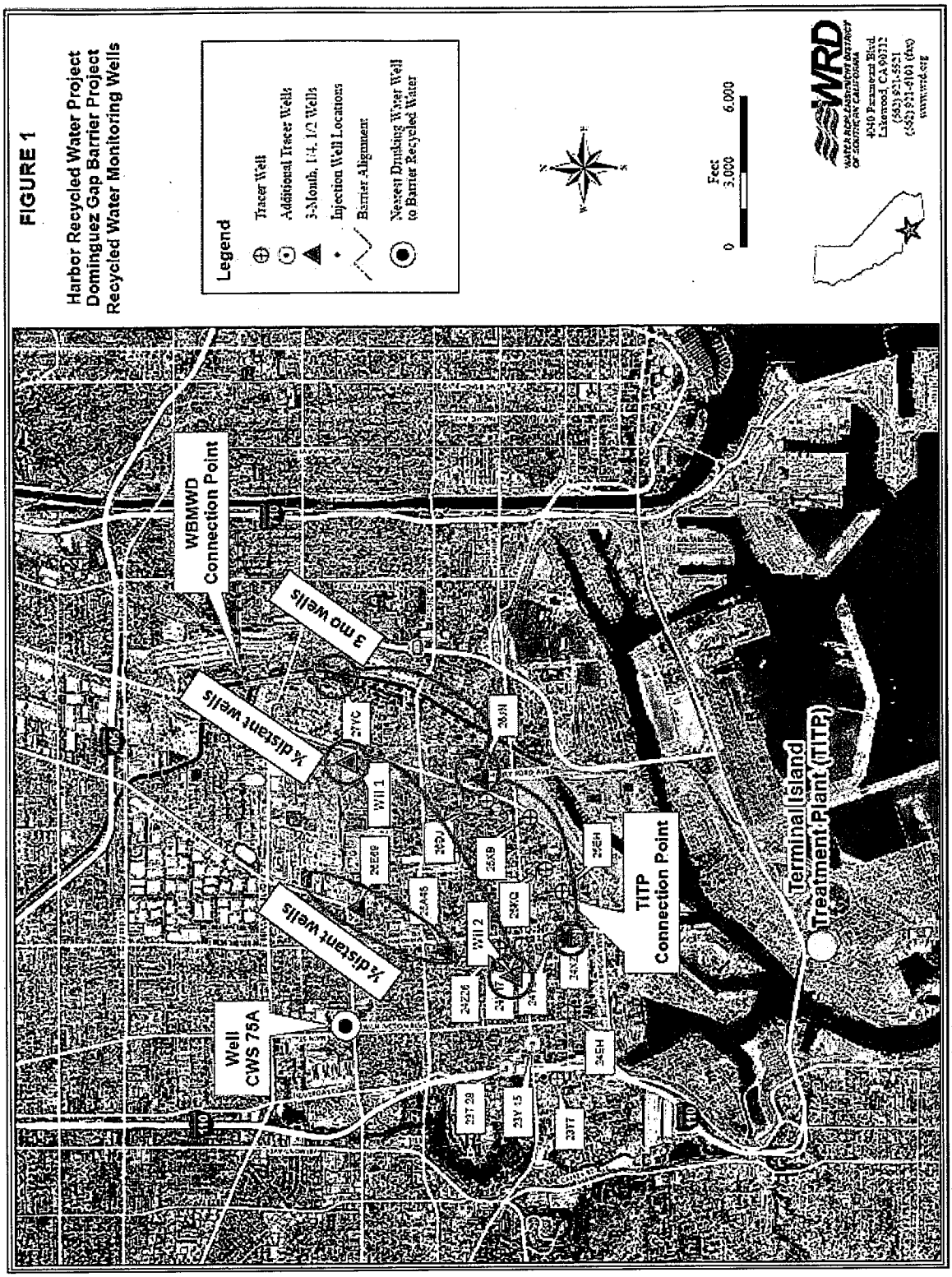
FIGURE 1
Harbor Recycled Water Project
Dominguez Gap Barrier Project
Recycled Water Monitoring Wells
Legend
Tracer Well
Additional Tracer Wells
3-3-month, 1-4, 1/2 Wells
Injection Well Locations
Barrier Alignment
Nearest Drinking Water Well to Barrier Recycled Water
Feet
0
3,000
6,000
WRD
WBMWD Connection Point
3 mo wells
½ distant wells
½ distant wells
Well CWS 75A
TITP Connection Point
Terminal Island Treatment Plant (TITP)

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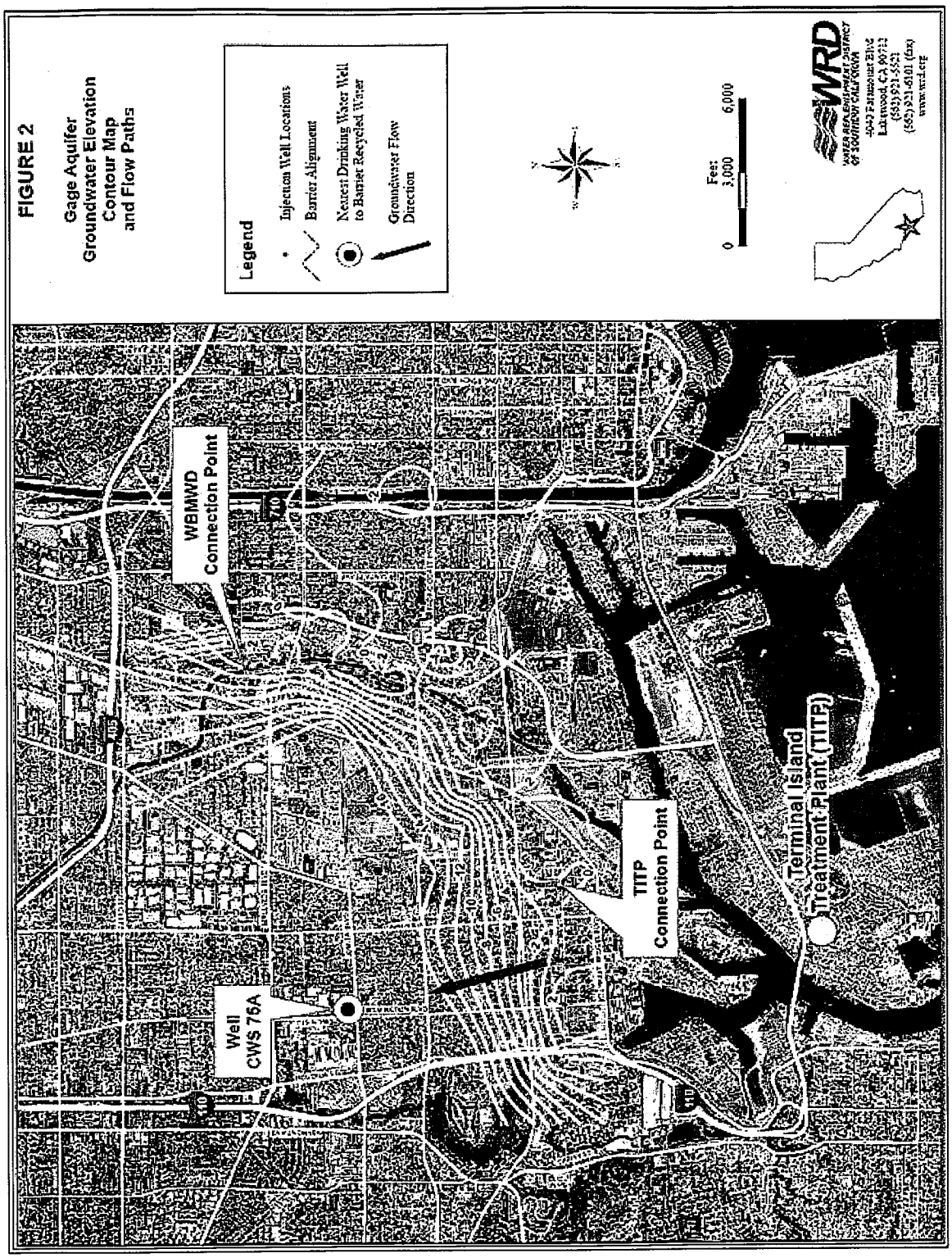
FIGURE 2
Gage Aquifer
Groundwater Elevation
Contour Map
and Flow Paths
Legend
Injection Well Locations
Barrier Alignment
Nearest Drinking Water Well to Barrier Recycled Water
Groundwater Flow Direction
Feet
0
3,000
6,000
WRD
WBMWD Connection Point
Well CWS 76A
TITP Connection Point
Terminal Island Treatment Plant (TITP)